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GB 2284359 A WO 95/23396 A1 WO 93/17764 A
US 5372511 A US 5087043 A US 4809246 A
US 4481412 A US 4273538 A

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(54) A book or board game with a sound generation system

(57) The book or game includes a movable image element 20 (Fig 5) or playing pieces 77 (Fig 14) which generate a sound when moved. The image element 20 includes an electrode 25 movable, by means of manual actuating tab 22, with respect to electrodes 26,27 in a folded double-page sheet. Contact or capacitively coupling between the electrodes generates a sound through circuits 28,29 linked to a sound synthesiser in the book cover or externally. The image element may form part of a pop-up device (51, Fig 12). The playing pieces 77 include electrodes 78 which link capacitively with electrodes 76 in the areas 74,75 of the game board 71 that the pieces are to be located, the sound generated being characteristic of the piece.

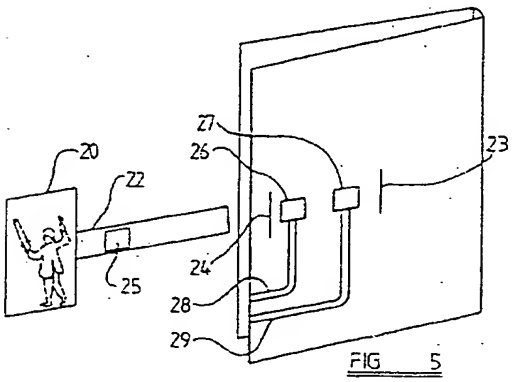


FIG 5

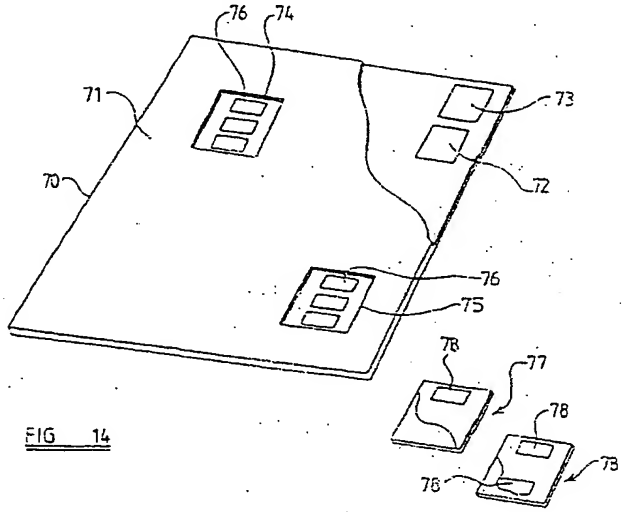


FIG 14

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FIG 1

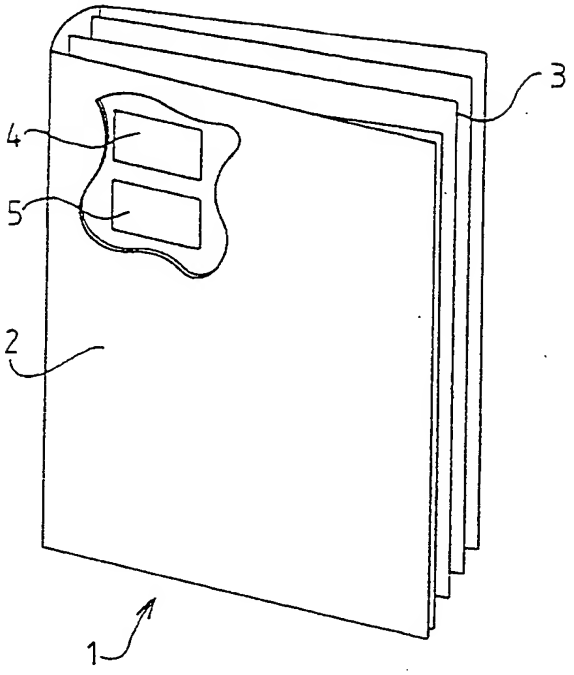
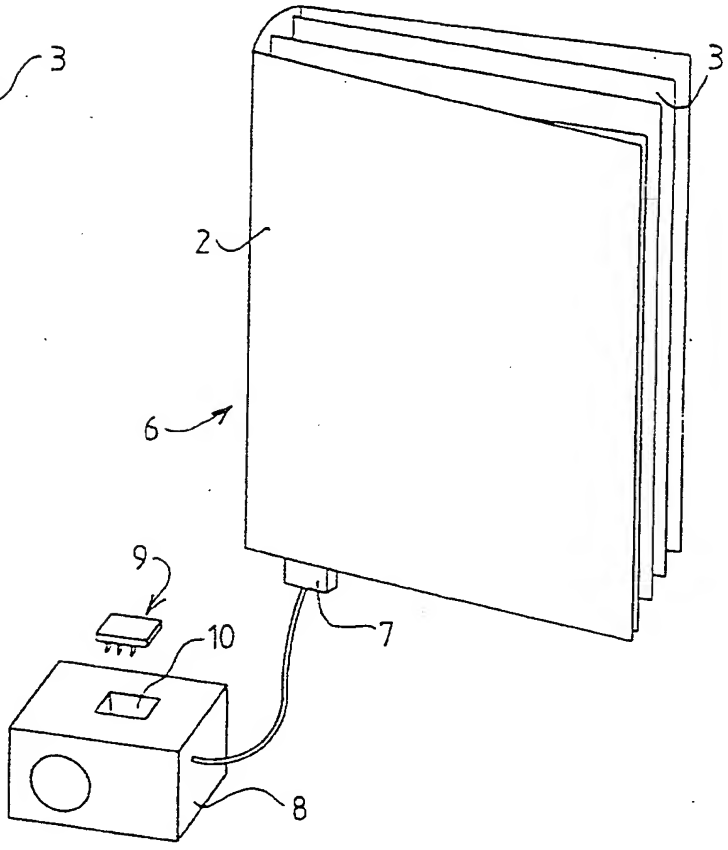



FIG 2



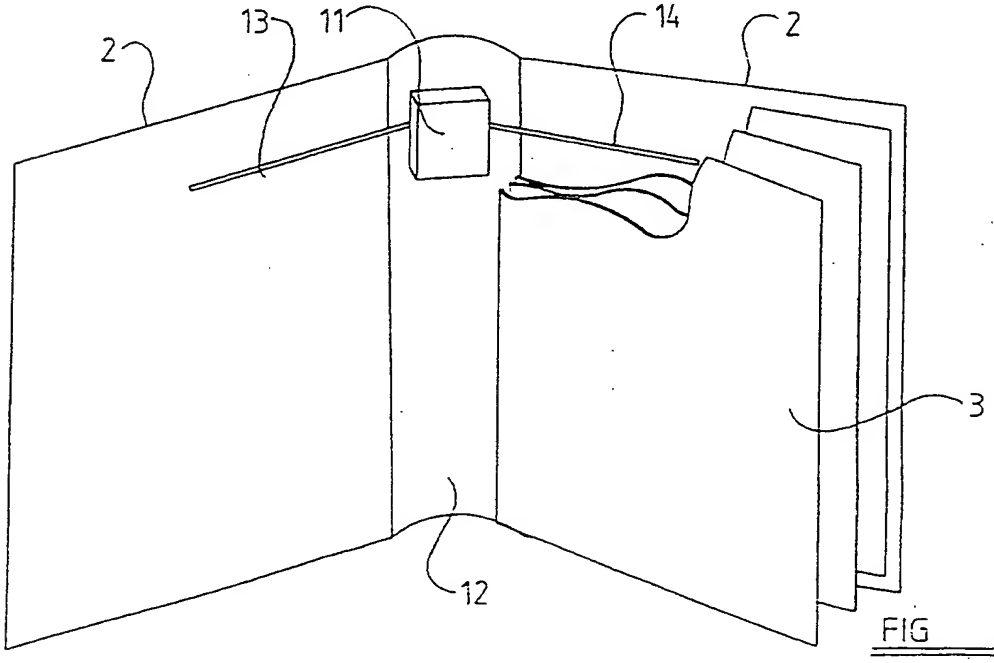
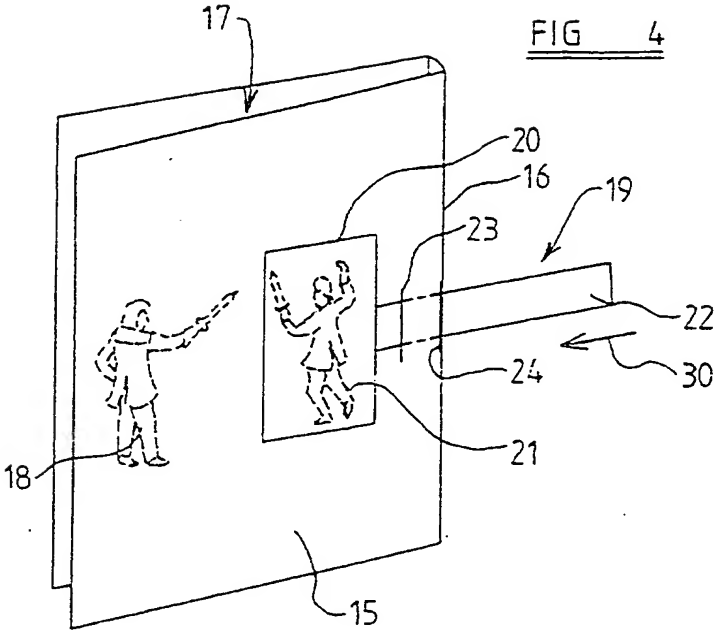




FIG 3

FIG 4



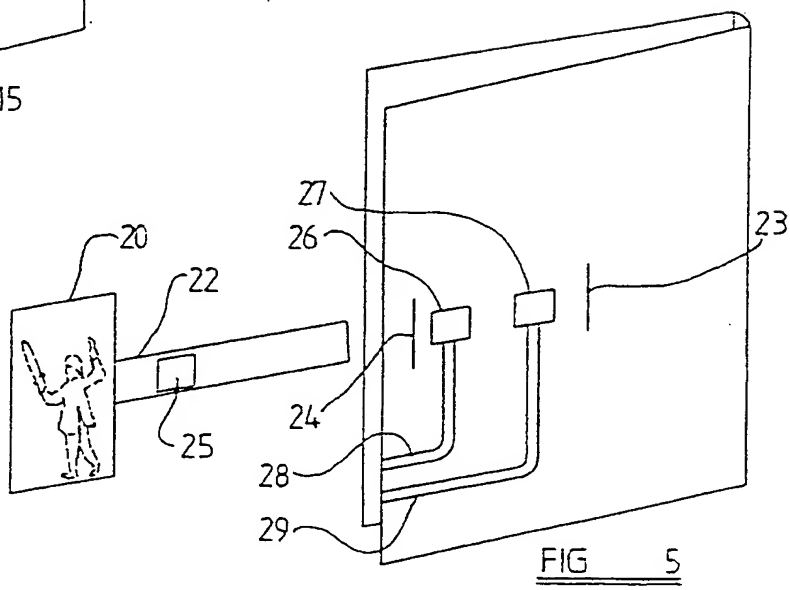




FIG 5

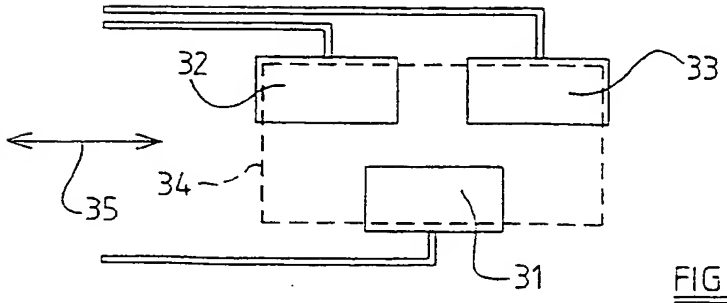



FIG 6

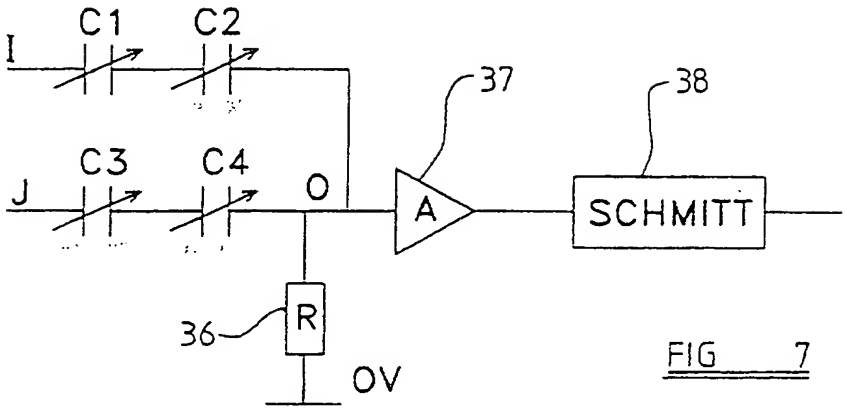



FIG 7

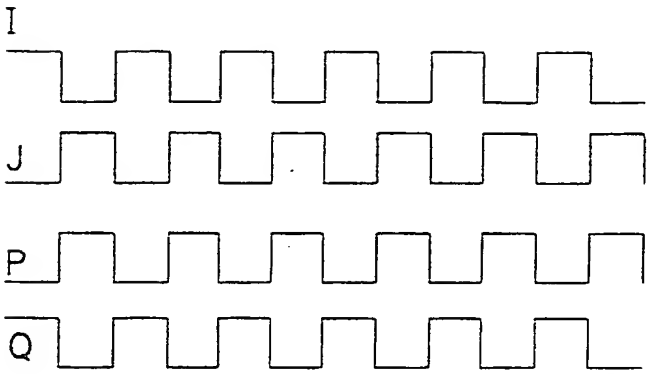



FIG 8

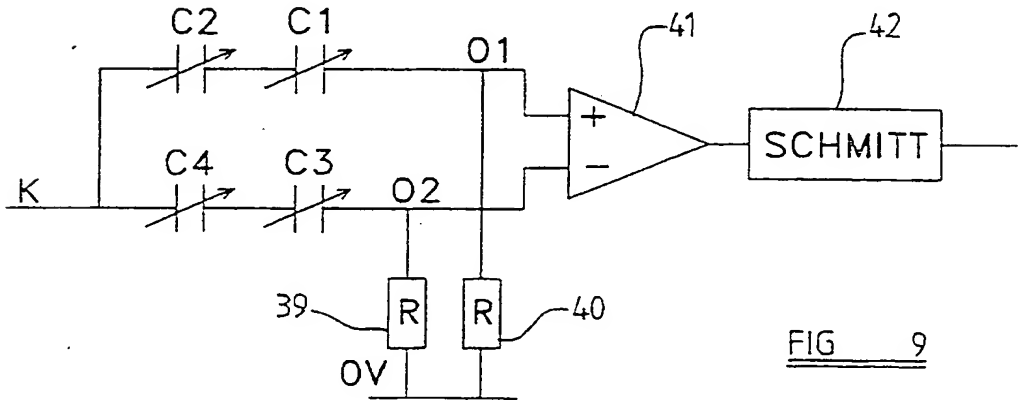
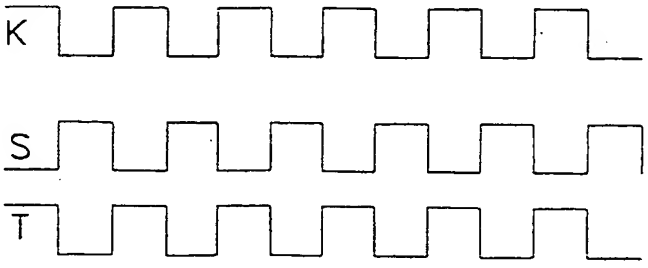



FIG 9

FIG 10



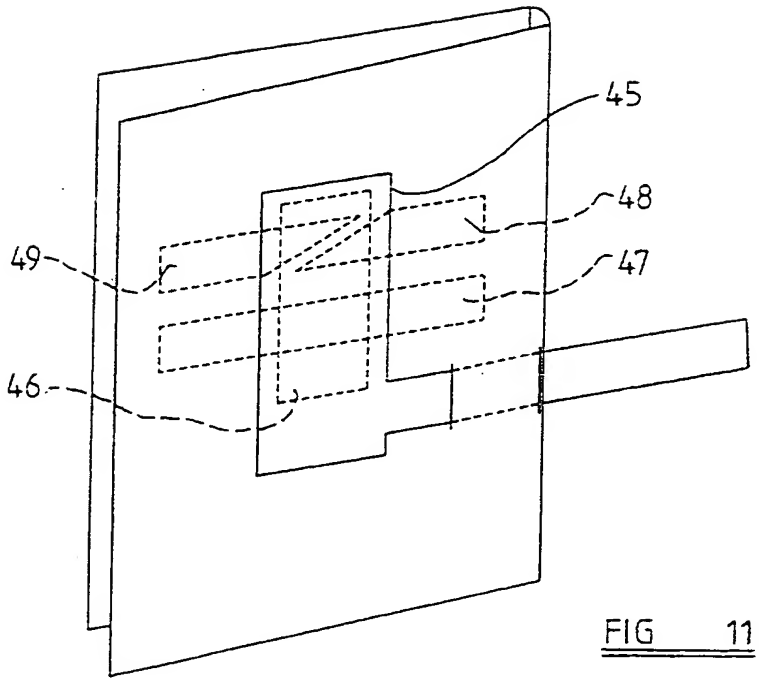



FIG 11

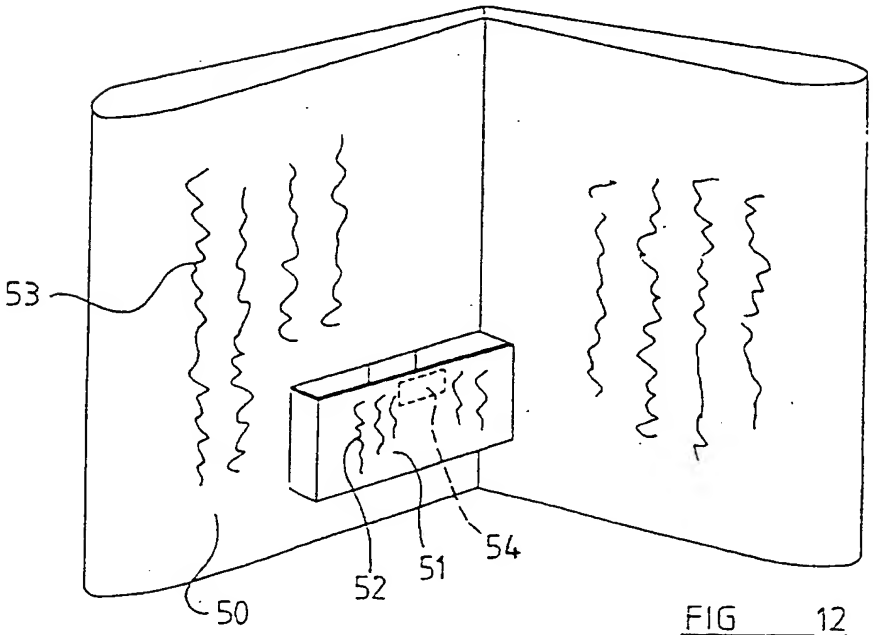
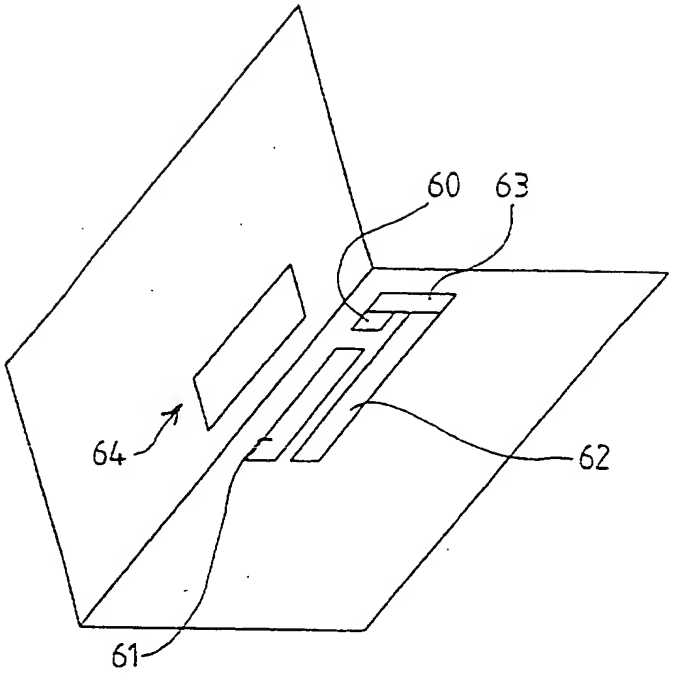



FIG 12

FIG 13



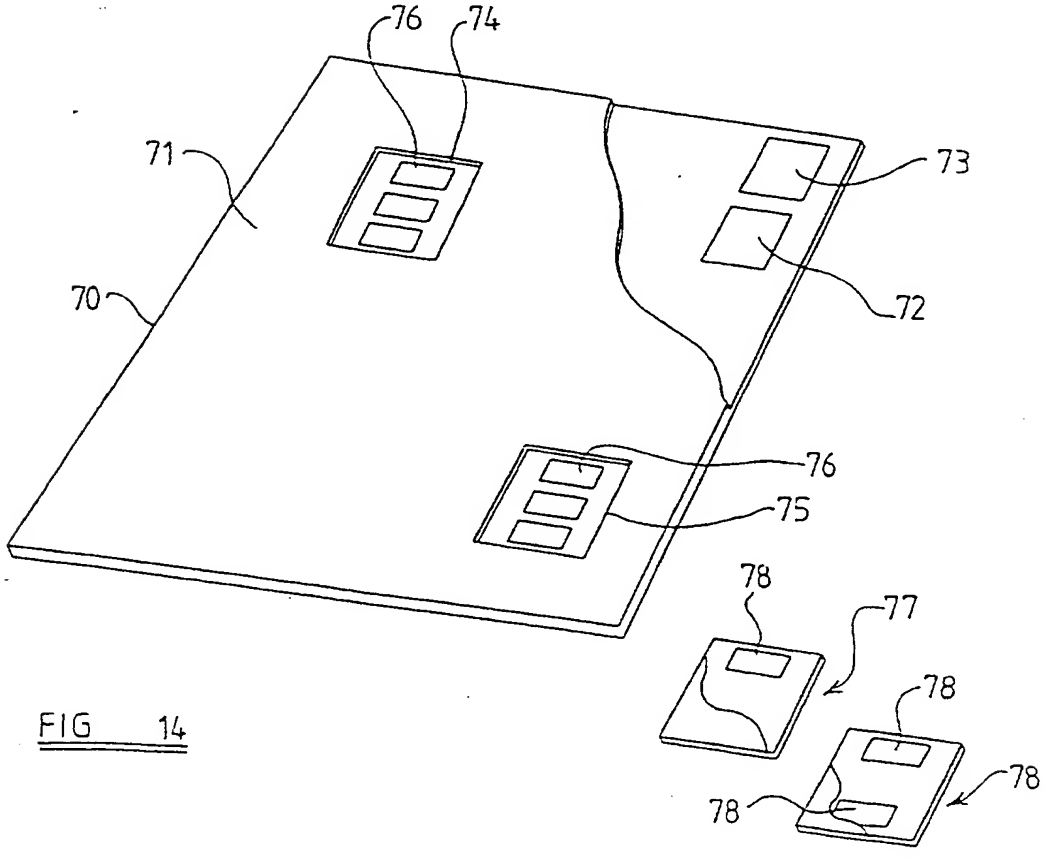




FIG 14

DESCRIPTION OF INVENTION

**"IMPROVEMENTS IN OR RELATING TO A TOY OR EDUCATIONAL DEVICE"**

**THE PRESENT INVENTION** relates to a toy or educational device and more particularly relates to a toy or educational device in the form of a book.

According to this invention there is provided a toy or educational device comprising means defining a surface, an element movable with respect to the surface, means to detect a predetermined movement of the element with respect to the surface and to generate a signal, means being provided to transfer the signal to a sound generating arrangement adapted to respond to the signal by generating a predetermined sound.

According to one embodiment of this invention there is provided a toy or educational device in the form of a book, the book comprising an outer cover and a plurality of pages, at least one page being associated with a movable element, the movable element carrying an element and being movable relative to the page, means being provided to detect a predetermined movement of the movable element relative to the page and to generate a signal, means being provided to transfer the signal to a sound generating arrangement adapted to respond to the signal by generating a predetermined sound.

The movable element may be movable manually and may be provided with a protruding tab adapted to be grasped manually to facilitate movement thereof. Alternatively, the movable element is in the form of a "pop-up" element which moves automatically from the first position relative to the page, to a second position relative to the page when the book is opened at that page.

Conveniently the sound generating arrangement is formed integrally with the book. Alternatively the sound generating arrangement is formed separately from the book, but is operationally connected thereto.

Conveniently the means to detect movement of the movable element comprises at least two electrodes, at least one electrode being carried by the movable element and at least one electrode being mounted in a fixed position on the book.

In one embodiment the electrodes are, in one position of the movable element, adapted to contact each other to establish electrical connection.

Alternatively the said electrodes are adapted to form capacitative couplings.

Conveniently at least two electrodes are mounted in fixed positions and one electrode is mounted on the movable element, a signal being applied to one fixed-position electrode being transferred to the other fixed-position electrode by the electrode carried on the movable element.

Advantageously three electrodes are provided which are fixed in position, at least one fixed-position electrode being provided with a signal which is transferred

to the remaining fixed-position electrode or electrodes by the electrode carried by the movable element.

In one embodiment two fixed-position electrodes are provided with anti-phase signals, the anti-phase signals being capacitive coupled to the remaining fixed-position electrode by the electrode carried by the movable element.

In a preferred embodiment one electrode is provided with a signal which is coupled to two fixed position electrodes which are connected to the inputs of a differential amplifier.

Preferably means are provided to determine the direction and degree of movement of the movable element.

Advantageously the movable element carries an electrode which capacitively couples a signal from one fixed-position electrode to two fixed-position electrodes which are of tapering form.

In another aspect of this invention there is provided a toy or educational device comprising means defining a surface, at least one separate playing element movable with reference to the surface, the surface defining at least one predetermined area where the playing element may be placed to rest on the surface, means being provided in said area to detect the presence of the playing piece when the playing piece has been moved to be in said predetermined area, and to generate a signal, means being provided to transfer the signal to a sound generating arrangement adapted to respond to the signal by generating a predetermined sound.

Preferably a plurality of different playing pieces are provided, the said detecting means being adapted to differentiate between the playing pieces.

Conveniently the detecting means comprise electrodes, each playing piece carrying one or more electrodes adapted, when the playing piece is in the predetermined area, to couple capacitatively the electrodes of the detecting means.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view, with part cut away, of one embodiment of the invention,

FIGURE 2 is a perspective view of an alternative embodiment of the invention,

FIGURE 3 is the view of the interior of a book forming one embodiment of the invention with parts thereof cut away,

FIGURE 4 is an illustration of one page of a book in accordance with the invention with a moving movable element,

FIGURE 5 is a view illustrating the front of the movable element illustrated in Figure 4 and the rear of the page,

FIGURE 6 is a view of an electrode arrangement,

FIGURE 7 is a circuit diagram showing one embodiment,

FIGURE 8 is a waveform diagram showing waveforms present in the circuit of Figure 7,

FIGURE 9 is a circuit diagram showing an alternative embodiment,

FIGURE 10 is a waveform diagram showing waveforms present in the circuit of Figure 9,

FIGURE 11 is a view of a further page of a book illustrating a further movable element, and, in phantom, a corresponding electrode arrangement,

FIGURE 12 is a view illustrating a double-page-spread of the book illustrating a pop-up element and the associated electrode arrangement,

FIGURE 13 is a view of a further page of the book illustrating an electrode arrangement used to indicate which particular page of a book has been opened, and

FIGURE 14 is a diagrammatic view of an alternative embodiment of the invention.

A book in accordance with the invention is, at first sight, of conventional form, having outer covers and inner pages. However, movable elements are provided within the book, carrying image elements, which are mounted in position for movement with respect to a particular page. It has been proposed previously to have such movable elements. Some prior movable elements may be moved manually, by grasping protruding tabs. They may be moved

linearly or arcuately. Portions of the image element carried by the movable element may initially be concealed, and may be revealed by movement of the movable element. Alternatively, the image element carried by the movable element may be moved relative to image elements carried by the page. Alternatively, prior movable elements are in the form of "pop-up" elements which move from a retracted position, in which they are adjacent the page, to an elevated position, in which they re above the page, as the book is opened at the respective page.

As will be described, in this invention means are provided which respond to the movement of the movable elements and which activate a sound generating arrangement, such as a sound synthesiser arrangement, so that an appropriate sound is emitted. Arrangements may also be provided so that an appropriate sound is emitted by the sound synthesiser when the book is initially opened, or when individual pages are turned.

Although the present embodiment is described with reference to a sound synthesiser, any sound generating system may be provided. The sound generating system may regenerate recorded sound or may synthesise sound from appropriate data.

Referring initially to Figure 1 of the accompanying drawings, a book 1 in accordance with the invention comprises an outer cover 2 and a plurality of pages 3. Embedded within the outer cover is a sound synthesiser 4 and a memory element 5. The sound synthesiser 4 incorporates a transducer or loudspeaker. As will become clear from the following description, under certain circumstances, signals may be fed to the memory element 5, with a consequence that the memory element 5 transfers

appropriate data signals representative of stored data within the memory element to the sound synthesiser 4, so that an appropriate sound is synthesised. It is to be appreciated that in this embodiment the sound synthesiser 4 and the memory element 5 are embedded within the cover of the book, meaning that the book is sold as a single entity and, as soon as purchased, is ready for operation.

Figure 2 illustrates a modified embodiment of the invention in which a book 6 is provided which, as in the previously described arrangement, comprises an outer cover and a plurality of pages 3. The outer cover is provided with a socket adapted to receive a plug 7 that is associated with a sound synthesiser 8. The sound synthesiser 8 incorporates a loud speaker or transducer. The sound synthesiser 8 is associated with a plug-in memory element 9. It is envisaged that in an arrangement of this type a book, such as the book 6 will be sold together with a corresponding memory element 9. The book may then be connected, by means of the plug 7, to a pre-purchased sound synthesiser 8. The memory element 9 will be inserted into an appropriate socket 10 present within the sound synthesiser 8. The book illustrated in Figure 2 will then operate in the same way as the book illustrated in Figure 1, but subsequently another book, together with another memory element 9 may be purchased, allowing the sound synthesiser 8 to be re-utilised.

The sound synthesiser may generate sound that is effectively stored in the memory element as a digital recording. Alternatively, appropriate sounds may be synthesised in accordance with predetermined criteria. In alternative embodiments the sound synthesiser may comprise, for example, a CD player which is controlled to play

selected tracks of a pre-recorded CD which corresponds, in effect, with the described memory element.

Referring now to Figure 3, it is to be understood that in a preferred embodiment of the invention, the book is provided with an arrangement which responds to the opening of the book which can serve to switch on or activate the sound synthesiser and the associated memory element. This means that when the covers of the book are closed, no electricity will be consumed. This means that any battery present in the book or otherwise associated with the sound synthesiser will not be drained when the book is not in use.

Referring to Figure 3, a switch housing 11 is provided which is connected to the spine 12 of the book, the switch housing having two elongate switch arms 13,14 which are connected to the front and rear covers 2 of the book. When the book is opened, to have the condition illustrated in Figure 3 (and here it is to be noted that in the condition illustrated in Figure 3 some pages 3 have parts thereof cut-away and some pages 3 have been omitted for the sake of clarity of illustration), the arms 13 and 14 are moved relative to the switch housing 11, thus causing the switch housing 11 to generate an appropriate signal which is passed to the sound synthesiser and memory element arrangement. This may cause the sound synthesiser to emit an appropriate sound. The switch is operated by movement of the front cover relative to the spine, movement of the back cover relative to the spine, or movement of the two covers relative to each other.

Referring now to Figures 4 and 5 of the accompanying drawings, one typical page 15 of the book is illustrated. The page is actually a "double page" formed

from a sheet which is folded about a fold-line 16 which forms the outer edge of the page. There is thus a space 17 defined between the face of the page that is visible in Figure 4 and the face of the page that is obscured in Figure 4.

The face of the page that is visible in Figure 4 carries an image element 18. A movable element 19 is provided comprising a flat region 20 which carries a further image element 21. Extending from the flat region 20, and formed integrally therewith, is an actuating tab 22 of elongate form. The tab 22 passes through a first slot 23 formed in the page 15, thus extending into the space 17, and also passes through a further slot 24 formed adjacent the edge of the page. The free end of the tab 22 is thus readily accessible for manual operation of the movable element.

Mounted on the front face of the portion of the tab 22 that is initially located between the slots 23 and 24, as can be seen in Figure 5, is a first electrode formed of a thin conductive foil 25 which may be made of copper or other conducting metal.

Formed on the rear face of the part of the page which forms the front page 15, as can be seen in Figure 5, the region between the two slots 23 and 24 are two further similar electrodes 26,27 which are connected by signal tracks 28,29 to a signal bus which may be provided within the spine of the book. The signal bus will extend to the memory element and sound synthesiser.

It is to be understood that when the movable element 20 has been inserted in position, the electrode 25 is immediately adjacent the electrodes 26 and 27. The

electrodes may establish electrical contact with each other, thus completing a current path from the signal track 28 to the signal track 29. Alternatively, the electrodes may be coated with a thin film of insulating material, in which case the electrodes may be capacitively linked, with the electrode 25 forming a capacitative coupling between the electrodes 26 and 27.

The extending end of the tab 22 may be moved inwardly, towards the left, as illustrated in Figure 4 by the arrow 30. This moves the image element 21 towards the image element 18. In the illustration the image elements resemble swordsmen and this movement of the image elements may be considered to represent a sword fight. However, this movement of the tab 22 causes the electrode 25 to move relative to the electrodes 26 and 27. If the electrode 25 initially established an electrical contact between these two electrodes, that electrical contact will now be broken, meaning that a detectable signal is present on the signal tracks 28 and 29. If, on the other hand, the electrode 25 established a capacitative coupling between the two electrodes 26 and 27, provided that an appropriate alternating current signal is supplied to one of the signal tracks 28, for example track 28, the movement of the electrode 25 will cause a difference in the signal that is capacitively coupled to the other signal track 29. Thus, again a detectable signal may be passed to the signal bus present in the spine of the book.

The sound synthesiser may respond to the detectable signal by developing sounds corresponding to the sounds that arise during a sword fight.

Thus, in the example given, movement of a tab associated with a movable element carrying an image element

relative to the page, which carries another image element, causes a predetermined sound to be generated by the sound synthesiser.

It is to be appreciated that in the arrangement illustrated in Figure 4 and Figure 5, it is not possible to determine the direction of movement of the movable element.

Figure 6 illustrates a modified electrode arrangement. Three electrodes 31,32,33 are provided which can be present on the fixed part of the page. It is to be observed that the electrode 31 is located at a position which is off-set relative to and intermediate the electrodes 32 and 33. The movable element may carry an electrode such as the electrode 34 which is illustrated in phantom. The electrode 34 is illustrated in an initial position in which the envelope of the electrode 34 substantially overlies the envelopes of each of the electrodes 31, 33 and 33. It can be seen that if the electrode 34 is moved to the left or right, as illustrated by the double-headed arrow 35, the envelope of the electrode 35 will no longer overlie all of the electrodes 31, 32 and 33.

If the electrode 34 makes electric contact with the electrodes 31, 32 and 33, it will be possible to determine when the electrode 34 has moved to the left when there is no longer an electrical connection between the electrode 31 and the electrode 33 and similarly, it will be possible to determine when the electrode 34 has moved to the right when there is no electric contact between the electrode 31 and the electrode 32.

Alternatively, however, a predetermined signal may be passed to the electrode 31 which will be coupled, in a

C1 and the capacitative coupling between electrode 34 and electrode 31 is indicated as C2.

Similarly, the capacitative coupling between electrode 33 and electrode 34 is indicated as C3 and the capacitative coupling between electrode 34 and electrode 31 is indicated as C4.

Anti-phase square-wave inputs I and J, shown in Figure 8, are applied respectively to electrodes 32 and 33.

The capacitors C2 and C4 each have one plate constituted by the electrode 31. That electrode 31 is connected to earth through a resistance 36 and is connected to one input of an amplifier 37, the output of which is connected to a Schmitt trigger 38 which "cleans-up" the output waveform.

Referring again to Figure 8, when the electrode 34 is located substantially over the plate 32, the output of the Schmitt trigger is the waveform shown at Q, whereas when the electrode 34 is substantially over the electrode 33, the output is the waveform as shown at P. A comparator may compare the output of the Schmitt trigger with the input waveforms to determine which of the two input waveforms is in-phase with the output waveform.

It is to be appreciated that any interference appearing at the input to the amplifier in the arrangement described may be amplified by the amplifier and affect the accuracy of detection.

Consequently, in an alternate arrangement, which is now described with reference to Figures 9 and 10, a single input K, in the form of a square-wave, as shown in Figure

capacitative manner (assuming that the electrodes do not establish electric contact with each other, but are insulated from one another), with both electrodes 32 and 33. Movement of the electrode 34 to the left will cause all of the signals supplied to the electrode 31 to be coupled to the electrode 32, with none of the signal being coupled to the electrode 33, whereas movement to the right will cause a substantial proportion of the signals coupled to the electrode 31 to be coupled to the electrode 33 with virtually none being coupled to the electrode 32. Consequently, with an electrode arrangement of this type, it is possible to determine the direction of movement of the element. This means that appropriate signals may be provided to the sound synthesiser indicating movement to the left and movement to the right, and the sound synthesiser may generate appropriate corresponding sounds.

Alternatively two signals, which are in anti-phase, may be supplied to the electrodes 32 and 33. When the electrode 34 is in the left-hand position, the signal that is applied to the electrode 31 will be in phase with the signal applied to electrode 32 and out-of-phase with the signal applied to electrode 33. Similarly, when the electrode 34 overlies the electrode 33, the signal present on electrode 31 will be in phase with the signal present on the electrode 33 and out-of-phase with the signal present on electrode 32. The signal track connected to the electrode 31 may thus be connected to an amplifier and a Schmitt trigger, which serves to "clean-up" the output waveform, and the phase of the output waveform can then be compared with the phases of the input waveforms in order to determine the position of the electrode 34.

Referring to Figure 7, the capacitative coupling between electrode 32 and the capacitor 34 is indicated as

10, is applied to the electrode 31. Through the capacitative couplings C1, C2 and C3, C4 respectively, the signal applied to the electrode 31 is coupled to the electrodes 32 and 33. The electrodes 32 and 33 are each connected as inputs, which are respectively connected to earth by resistors 39,40, of a differential amplifier 41. The output of the differential amplifier 41 has the waveform S shown in Figure 10, which is out-of- phase with the input K, when the electrode 34 is located over the electrode 33, but has the output waveform shown at T in Figure 10, which is in phase with the input K, when the electrode 34 is located over the electrode 32.

As in the previous arrangement (see Figure 7), the output of the amplifier is connected to a Schmitt trigger circuit 42 which will "clean-up" the output waveform.

It is believed that the arrangement of Figures 9 and 10 may avoid any problems that might otherwise arise due to "noise".

Figure 11 illustrates yet another arrangement in which the direction of movement and the degree of movement can be determined.

In the arrangement of Figure 11, a movable element 45 carries an electrode 46 on its rear face which co-operates with three electrodes 47,48,49 which are mounted on the page. In arrangement of this type, it is to be appreciated that the material of the page itself serves to separate the electrodes, acting as the dielectric of a capacitor. The movable element 46 is of a similar design to the movable element 20 and carries an image element.

The electrode 47 is an elongate electrode extending over the entire extent of movement of the movable element. A signal, which is supplied to the electrode 47 is consequently coupled to the electrode 46 regardless of the positioning of the movable element 45.

The remaining two electrodes 48 and 49 extend substantially parallel to the electrode 42, but are shaped to define a "skive" joint. Thus the electrode 48, which is located towards the right as shown in Figure 7, tapers towards its left-hand edge, whereas the electrode 49, which is located towards the left, tapers towards its right-hand edge.

As the electrode 46 moves from an initial right-hand position, in which virtually all of the signal that is capacitively coupled to the electrode 46 from the electrode 47 is capacitively coupled to the electrode 48, to a terminal position at the left where all of the signal from the electrode 47 is correspondingly coupled to the electrode 49. When the electrode 46 is in an intermediate position, as shown, part of the signal is coupled to the electrode 48 and part is coupled to the electrode 49. By comparing the amplitude of the signal coupled to the electrodes 48 and 49, it is possible to determine, with a reasonable degree of accuracy, the position of the movable element 45.

It is to be appreciated that in an alternative arrangement, out-of-phase waveforms may be supplied to the electrodes 48 and 49, and the amplitude and phase of the signal coupled by the electrode 46 to the electrode 47 may be determined in order to locate the position of the movable element 45.

Of course, many other alterative electrode arrangements may be utilised.

Figure 12 illustrates a further page 50 of the book which incorporates a so-called "pop-up" movable element 51. A movable element of this type is an element which, when the book is in the closed condition, lies flat relative to the page, but when the book is opened, emerges or "pops-up" to stand proud of the page. The movable element 51 carries an image element 52 which co-operates with a further element 53 carried by the remainder of the page to form a composite image.

In the illustrated embodiment, an electrode 54 is provided mounted on the rear surface of the pop-up element 51, which co-operates with a further electrode 55 which is mounted on the rear of the next adjacent page, so that when the book is in the closed condition, the electrode 54 is immediately adjacent the electrode 55, whereas when the book is opened at the illustrated page, the electrode 54 is separated from the electrode 55. By monitoring the effective capacitance between the electrodes 54 and 55, it is possible to determine when this page of the book has been opened and the "pop-up" element has moved to the illustrated condition, thus causing an appropriate signal to be generated which is supplied to the sound synthesiser, again to cause the appropriate sound to be synthesised.

Figure 13 illustrates a further arrangement which may be utilised to determine which particular page of a book has been opened. By utilising an arrangement of this type, it is possible to minimise the number of contacts with the "bus" and the memory module since, for each page

of the book that is open, only a relatively small number of movable elements may be provided.

Referring now to Figure 13, on one page of the book, two input electrodes 60,61 are provided to which may be connected two out-of-phase inputs, in the same way that two out-of-phase inputs were used in the arrangement illustrated in Figures 7 and 8. Thus, a waveform, such as the waveform I, as described with reference to Figures 7 and 8, may be applied to the electrode 60 and a waveform, such as the waveform J described with reference to Figures 7 and 8 may be applied to the electrode 61.

An output electrode 62 is provided on the page, which may be connected to an amplifier such as the amplifier 37 as shown in Figure 7. A relatively small bias electrode 63 is provided which is permanently mounted in position to provide a relatively weak capacitative coupling between the electrode 60 and the electrode 62. However, it is to be observed that on the facing page of the book, a further coupling electrode 64 is provided which, when the book is closed, serves to couple the electrode 61 to the electrode 62. It is to be noted that the electrode 61, and the co-operating electrode 64, is much larger than the electrode 60 and the bias electrode 63.

Thus, when the book is closed, the signal coupled from the electrode 61 to the electrode 62 by the electrode 64 is much greater than the signal coupled to the electrode 62 from the electrode 60 by the bias plate 63, meaning that the signal applied to the electrode 60 is "swamped" in the output from the electrode 62. However, when the book is opened, to have the condition illustrated in Figure 13, it is the signal that is coupled from the

electrode 60 to the electrode 62 by the bias plate 63, that is found to exist.

Whilst the arrangement shown in Figure 13 illustrates one technique for identifying which page of a book is open, it is to be appreciated that many alternative techniques may be utilised. For example, each page of the book may be provided with a photo-sensor. Of course, only the photo-sensor present on the page of the book that is actually open will be exposed to light. Mechanical switching means may be utilised, or, alternatively, Hall-effect transistors can be utilised, with a Hall-effect transistor being mounted on one page with a magnet being mounted on the opposite page adapted to be located immediately adjacent the Hall-effect transistor when the book is closed, but to be spaced from that transistor when the book is open. All of the Hall-effect transistors will be rendered conductive by the magnet field applied to them by the adjacent magnets when the book is closed. However, when the book is opened, one transistor will go non-conductive because it has become separated from its associated magnet, giving an indication as to precisely which page is open.

When means are provided to determine the page at which the book is open, when the book is opened at a particular page, the sound synthesiser may generate an appropriate sound. This may be a general description of the scene depicted on the open page, or relevant sound effects.

Whilst the invention has been described with specific reference to "movable elements" which slide and to a particular design of "pop-up", it is to be appreciated that the invention applies equally to movable elements

which rotate or which follow an arcuate path, and to "pop-up" elements which operate in a different way to that illustrated.

It is to be appreciated that utilising the principles outlined above, it is possible to develop a book which may be extremely attractive to a child.

As mentioned in the examples given, when a movable element is moved, an appropriate sound may be generated. As mentioned with reference to the embodiment of Figures 4 and 5, if the movable element carries an image element corresponding to a swordsman, when that movable element is moved, the sound generated may be the sound of a sword fight. If, alternatively, the movable element, when moved, causes the effective size of a person to grow, for example, an image representative of "Alice" in the book "Alice in Wonderland", a sensor such as that shown in Figure 11 may be utilised, and as the movable element moves successively, a sound of increasing volume may be generated. Thus, when "Alice" is relatively small, only a low volume sound is created, whereas when "Alice" is very tall, a much higher volume sound is created. In some cases, movable elements may be provided which can be moved between a plurality of predetermined positions, and when at each position, a predetermined sound may be generated by the sound synthesiser.

Whilst, in the described embodiments, reference has been made to the use of direct contact between electrodes and capacitative couplings between electrodes, with the electrodes being present on parts of the book that are movable relative to each other, it is to be appreciated that other techniques will be used to detect such movement. For example, inductive coupling may be utilised, and Hall-

effect transistors could be utilised which co-operate with magnets. In such an arrangement, a Hall-effect transistor would be mounted in a fixed position and a magnet, present on the movable element, would move relative to the Hall-effect transistor. Equally, optical switches may be utilised. In such an arrangement a light fibre may be present on the movable element which initially provides an optical path between a light-emitting diode and a photo-sensor. As the movable element is moved, the nature of the optical connection established by the light fibre changes, thus providing a detectable signal.

Alternative arrangements will suggest themselves to those skilled in the art.

Referring now to Figure 14, an alternative embodiment of the invention is illustrated.

In the embodiment of the invention, a game board 70 is provided which defines an upper surface 71 which may carry an appropriate image. Embedded within the sound board is a sound synthesiser 72 and an associated memory element 73 corresponding to those described above.

Formed on the surface of the game board 71 are a plurality of areas 74,75 which may be defined a printed outer borderline, or which may be formed as physical recesses or depressions in the surface of the game board.

Associated with each of the areas 74,75 are a plurality of electrodes illustrated as electrodes 76. The electrodes are connected to the sound synthesiser 72.

A plurality of playing pieces 77,78 are provided. Each playing piece incorporates one or more sheets of

metallic foil 78. The playing pieces are dimensioned to be placed on the areas 74 or 75. When a playing piece has been located in position, the one or more elements of foil 78 will capacitatively couple two or more of the electrodes 76 associated with the respective area. Depending upon the location of the metallic foil element 78 in each of the playing pieces, a different signal will be generated by the electrodes 76 in the area in which the playing piece has been located. Thus, the arrangement described, is capable of differentiating between playing pieces.

Consequently, it is to be understood that the playing board 70 defines a plurality of different areas each adapted to receive a playing piece. Each area is provided with electrodes forming part of a detecting system. When a playing piece executes a predetermined movement and is placed on one of the areas, the detecting system detects the fact that the playing piece has moved and also identifies the playing piece. An appropriate signal is passed to the sound synthesiser and consequently, an appropriate sound is generated.

The sound generated may depend upon the nature or identity of another playing piece already present in another area on the board.

For example, the playing pieces may represent characters. The board may carry depiction of a house. When a first playing piece, corresponding to a first character, is located in one of the predetermined areas on the board, the sound synthesiser may generate a sound representative of the character saying "Gosh! what a creepy house! Where am I?". After a period of time, if there is no further activity, the sound synthesiser may generate a

further sound corresponding to the character saying "I wish someone else would come along".

If a second playing piece, corresponding to a second character, is then placed in a second predetermined area on the board, the sound generator may generate a sound equivalent to the first character saying "Gosh! Who are you?", and may subsequently generate a sound corresponding to the second character introducing himself to the first character.

Whilst in the illustrated embodiment, a simple board has been shown, it is to be appreciated that the board could form part of a small "stage" with an associated back-drop. Means may be provided for various different "scenes" on the back-drop. The sound synthesiser may be adapted to be provided with a signal representative of which back-drop is in place, enabling appropriate sounds to be generated. The playing pieces, whilst illustrated as being flat, may comprise three-dimensional models of characters, with the metallic foil elements 78 being provided in the base of each element.

Whilst this embodiment has been described with reference to a playing board, it is to be appreciated that the sensing system used is identical to that described above, with reference to the book. Also, it is to be appreciated that the arrangement described in Figure 14 could be incorporated into a plurality of pages present on a book.

It is to be appreciated that in the above described embodiments of the invention, arrangements have been disclosed in which a capacitative coupling is accomplished by moving metal foil or metal foil electrodes relative to

one another. However, sensing of movement, especially of movable elements present in a book, could be accomplished by having electrodes fixed in position and by having the movable element incorporating a portion of material of a predetermined permittivity movable between the electrodes in order to adjust the capacitative coupling existing between the electrodes.

CLAIMS:

1. A toy or educational device comprising means defining a surface, an element movable with respect to the surface, means to detect a predetermined movement of the element with respect to the surface and to generate a signal, means being provided to transfer the signal to a sound generating arrangement adapted to respond to the signal by generating a predetermined sound.

2. A toy or educational device in the form of a book, the book comprising an outer cover and a plurality of pages, at least one page being associated with a movable element, the movable element carrying an image element and being movable relative to the page, means being provided to detect a predetermined movement of the movable element relative to the page and to generate a signal, means being provided to transfer the signal to a sound generating arrangement adapted to respond to the signal by generating a predetermined sound.

3. A device according to Claim 2, wherein the movable element is movable manually.

4. A device according to Claim 3, wherein the movable element is provided with a protruding tab adapted to be grasped manually to facilitate movement thereof.

5. A device according to Claim 2, wherein the movable element is in the form of a "pop-up" element which moves automatically from the first position relative to the page to a second position relative to the page when the book is opened at that page.

6. A device according to any one of the preceding Claims wherein the sound generating arrangement is formed integrally with the book.

7. A device according to any one of Claims 2 to 6 wherein the sound generating arrangement is formed separately from the book, but is operationally connected thereto.

8. A device according to any one of the preceding Claims wherein the means to detect movement of the movable element comprises at least two electrodes, at least one electrode being carried by the movable element and at least one electrode being mounted in a fixed position on the book.

9. A device according to Claim 8 wherein the electrodes are, in one position of the movable element, adapted to contact each other to establish electrical connection.

10. A device according to Claim 8 wherein the said electrodes are adapted to form capacitative couplings.

11. A device according to Claim 10 wherein at least two electrodes are mounted in fixed positions and one electrode is mounted on the movable element, a signal being applied to one fixed-position electrode being transferred to the other fixed-position electrode by the electrode carried on the movable element.

12. A device according to Claim 11 wherein three electrodes are provided which are fixed in position, at least one fixed-position electrode being provided with a signal which is transferred to the remaining fixed-position

electrode or electrodes by the electrode carried by the movable element.

13. A device according to Claim 12 wherein two fixed-position electrodes are provided with anti-phase signals, the anti-phase signals being capacitive coupled to the remaining fixed-position electrode by the electrode carried by the movable element.

14. A device according to Claim 12 wherein one electrode is provided with a signal which is coupled to two fixed position electrodes which are connected to the inputs of a differential amplifier.

15. A device according to any one of the preceding Claims wherein means are provided to determine the direction and degree of movement of the movable element.

16. A device according to Claim 15 wherein the movable element carries an electrode which capacitively couples a signal from one fixed-position electrode to two fixed-position electrodes which are of tapering form.

17. A toy or educational device comprising means defining a surface, at least one separate playing element movable with reference to the surface, the surface defining at least one predetermined area where the playing element may be placed to rest on the surface, means being provided in said area to detect the presence of the playing piece when the playing piece has been moved to be in said predetermined area, and to generate a signal, means being provided to transfer the signal to a sound generating arrangement adapted to respond to the signal by generating a predetermined sound.

18. A device according to Claim 16 wherein a plurality of different playing pieces are provided, the said detecting means being adapted to differentiate between the playing pieces.

19. A device according to Claim 16 wherein the detecting means comprise electrodes, each playing piece carrying one or more electrodes adapted, when the playing piece is in the predetermined area, to couple cpacitatively the electrodes of the detecting means.

20. A toy or educational device substantially as herein described with reference to and as shown in the accompanying drawings.

21. Any novel feature or combination of features disclosed herein.

The Patent Office

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**Application No:** GB 9602324.7
**Claims searched:** 1-20

**Examiner:** Graham Russell
**Date of search:** 20 March 1997

## Patents Act 1977
## Search Report under Section 17

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): A6H (HKA); B6A (ADE)

Int Cl (Ed.6): A63F 9/10; A63H 33/38; B42D 1/00, 3/12; G09B 5/06

Other: Online: WPI

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | | Relevant to claims |
|---|---|---|---|
| X | GB 2284359 A | (HART) | 1,17,18 |
| X | WO 95/23396 A1 | (LEAPFROG) see page 7 lines 16-28 | 1,17-19 |
| X | WO 93/17764 A3 | (JESSOP) see page 24 line 21 - page 25 line 26 | 1,17-19 |
| X | US 5372511 | (TECTRON) see column 3 lines 22-42 | 1,17,18 |
| X | US 5087043 | (SIGHT AND SOUND) see column 2 line 24 - column 3 line 7 | 1,17,18 |
| X | US 4809246 | (JENG) see column 4 lines 31-47 | 1-3 |
| X | US 4481412 | (FIELDS) see column 8 lines 12-34 | 1 |
| X | US 4273538 | (ROSS) see Fig 2 & column 3 line 20 - column 4 line 3 | 1-3,6,7 |

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